THE AMPHIBIAN CRISIS:
An assessment in Costa Rica

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Since the late 1980's amphibian species have been rapidly declining all over the world becoming, in 40 years, the most threatened vertebrate class in the world. These declines have been occurring even inside protected and well preserved areas, meaning that not only habitat loss is affecting amphibians, but other stressors such as climate change or diseases are impacting amphibian populations. To know the extent of these declines and how we can prevent them, it is important to gather information on current amphibian conservation status.

MAIN GOALS

The main goal of this study is to gather and analyse the information on the conservation status of all the amphibian species f Costa Rica in order to identify the level of protection of the endemic and non endemic species. To do so, five objectives have been set.

1. **Summarize Costa Rican amphibian diversity.**
2. **Analyze amphibian current conservation status.**
3. **Determine amphibian main threats in the country.**
4. **Assess if protected areas (PAs) offer actual protection to amphibian populations.**
5. **Identify and propose conservation actions in the region**

METHODOLOGY

- Goals 1,2,3 and 5 → **search**, **review** and **synthesis** of articles.
- Goal 4
  - Percentage of **area protected vs total distribution area** calculated for each amphibian species with enough data (83%). Data obtained from the mapping interface *BerkeleyMapper*.
  - Statistical analyses → **TWO-WAY ANOVA** determining if threatened species distributions are comprised inside protected areas.

1. AMPHIBIAN DIVERSITY

ORDER

CAUDATA — 25%
- 1 Family
- 34 Endemic spp.
- 17 Non endemic spp.

GYMNOPHIONA — 3%
- 1 Family
- 3 Endemic spp.
- 4 Non endemic spp.

ANURA — 72%
- 12 Families
- 22 Endemic spp.
- 126 Non endemic spp.

HIGH DIVERSITY

Costa Rica has **3% of all amphibian species** in the world while it just represents a 0.01 of the world's land area!

HIGH ENDEMICITY

The great diversity of ecosystems allows more specialization, with **30% of the species being found nowhere else** in the world (endemic species).

2. CONSERVATION STATUS

Table 1: Number and percentage of amphibian species according to the IUCN Red List status. CR: Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near Threatened; LC: Least Concern; DD: Data Deficient; B: Blank; E: Extinct.

		ENDEMIC	NON ENDEMIC	TOTAL	GLOBAL
THREATENED	CR	5 (8%)	17 (12%)	22 (11%)	32%
	EN	10 (17%)	13 (9%)	23 (11%)	
	VU	9 (15%)	5 (3%)	14 (7%)	
NOT THREATENED	NT	3 (5%)	7 (5%)	10 (5%)	41%
	LC	7 (12%)	93 (64%)	100 (49%)	
UNKNOWN	DD	11 (19%)	6 (4%)	17 (8%)	25%
	B	11 (19%)	5 (3%)	16 (8%)	
	EX	3 (5%)	0 (0%)	3 (1%)	2%
	TOTAL	59	146	205	

- Costa Rican species are **less threatened** and **better known** than global trends
- **Endemic species** (which increase diversity and uniqueness) are far **less known** and **more threatened** than non endemic species.

4. MAIN THREATS

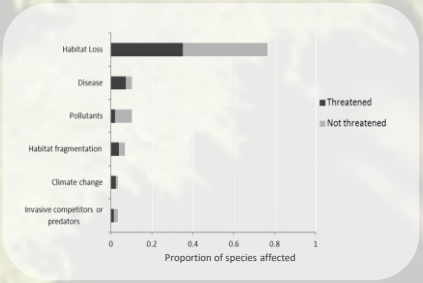

Figure 1: Specific threats to the amphibians of Costa Rica. Extracted from amphibiaweb database.

HABITAT LOSS
- More than 75% of amphibian species affected.

DISEASES
- Wider proportion of threatened species affected.
- **Chytridiomycosis** disease has been the **main cause** of the global amphibian decline.

POLLUTANTS
- Affect amphibians directly killing them or producing **sublethal effects** like behaviour disruption or fertility reduction.

OTHERS
- Also participate in the accentuation of amphibian declines.

4. PROTECTED AREAS ASSESSMENT

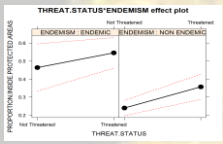

Figure 2: TWO-WAY ANOVA plot. Factors Endemism and Threat are significant but not the interaction between both factors.

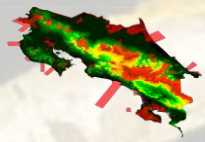

Figure 3: Costa Rican elevation map with all protected areas painted in red.

- Threatened species tend to be more inside PAs than not threatened species (p-value 0.0032**).
- Endemic species tend to be more inside PAs than non endemic species (p-value <0.0001***).

WHY ARE SPECIES DECLINING INSIDE PAS?

Stressors do not respect PAs boundaries
Most PAs are in mid to high elevations where chytridiomycosis has been more active

They have already disappeared from non protected areas
Slower disappearance rates inside PAs

Other **conservation actions** besides habitat protection must be implemented

5. CONSERVATION ACTIONS

In the last 50 years 250 studies in amphibian biology have been carried out in Costa Rica and one fifth of them were conservation studies. Here we purpose some approaches to alleviate the current amphibian diversity crisis en Costa Rica, one of the top hot-spots of biodiversity in the world.

1. **INCREASE DIVERSITY AND BIOLOGY DOCUMENTATION**
   - 33 species have not any IUCN CATEGORY yet.
   - Vast information on amphibian ecology and basic biology remains unknown.
2. **INCREASE LONG-TERM MONITORING PROGRAMS**
   - Discern population fluctuations from real declines.
   - Better understand population dynamics.
3. **DETECT AND STUDY RELICT POPULATIONS**
   - Recent rediscovery of disappeared populations.
   - Vital for finding a cure to chytridiomycosis.
4. **CREATE CAPTIVE-BREEDING PROGRAMS**
   - Necessary to ensure survival for the most threatened species.
5. **STUDY SYNERGISMS BETWEEN STRESSORS**
   - Stressors are found in overlapping areas.
   - Still few studies on stressors interactions.

CONCLUSIONS

- Costa Rica is a country with high levels amphibian **diversity** and **endemicity**.
- Costa Rica has a **well known amphibian fauna** compared with the rest of the world, but many species are still in need to be assessed.
- **Habitat Loss** is the major stressor outside PAs.
- Most **threatened species** are found inside PAs.
- **Diseases** and **pollution** are the major stressors causing declines inside PAs.
- Different **conservation actions** should be taken to ensure a good recovery of the amphibian populations.

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